

## More on Experimental Design

### • Three Principles of Experimental Design

#### 1. Control

- We try to control sources of variation to make conditions similar for all treatment groups.

#### 2. Randomize

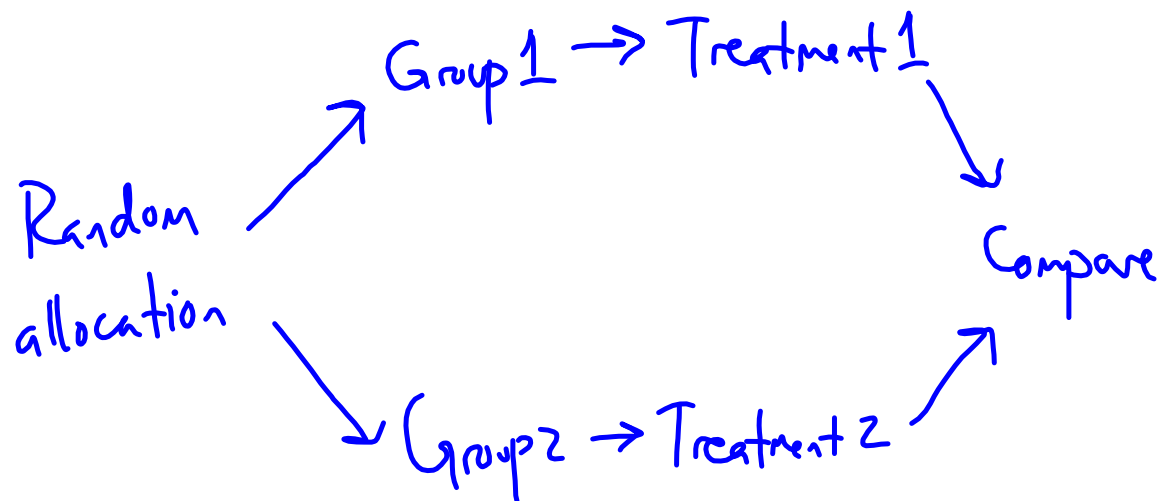
- Randomization allows us to equalize the effects of unknown or uncontrollable sources of variation.

#### 3. Replicate.

- Apply each treatment to several subjects.
- Replicate the entire experiment.

- Diagram

- Way to visualize experimental process.

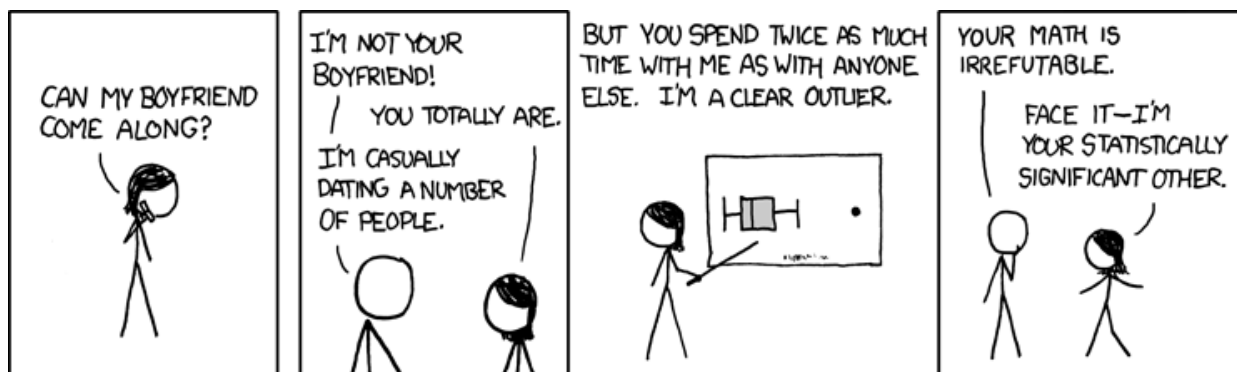


- Statistical Significance

- Under the "Compare" part

- Question is what we observe based on chance or on the treatments?

- If differences are from treatments, we say they are "statistically significant"



- Control Treatments:
  - We need a baseline measurement from a group that has no treatment.
  - Call this a control group.
- Blinding:
  - Two main classes of individuals who can influence the outcome:
    1. Those who influence the results (subjects, treatment administrators)
    2. Those who evaluate the results (judges, treating physicians)
  - Single-blind → when one of the classes does not know about critical aspects of the study
  - Double-blind → everyone in both classes does not know

- Placebos:

- A "fake" treatment that looks just like the real treatment
- "Placebo effect" → people getting placebo show improvements

- The best experiments...

- Randomized
- Comparative
- Double-blind
- Placebo-controlled

- Blocking:

- If pre-existing differences between experimental units exist, then we put them in blocks.
- We randomly choose from each block.

- Matching:

- In an observational study, we can group subjects who are similar in ways we are NOT studying.

- Confounding:

- Factors are confounded when levels of one factor are entangled with levels of another.

